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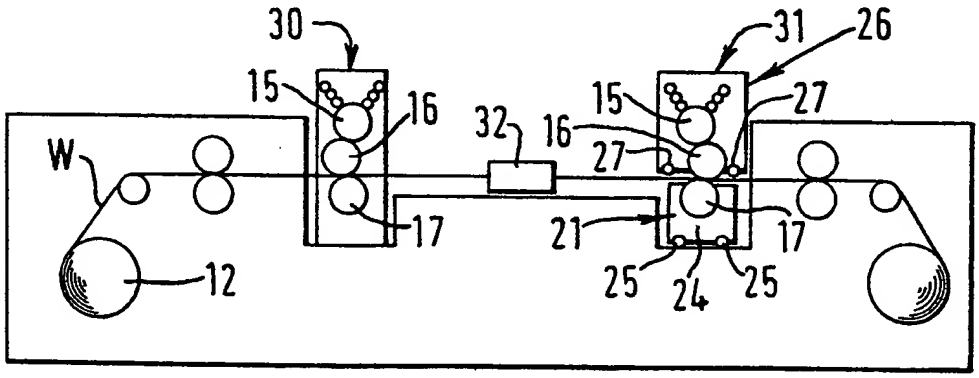

(57) Abstract

The apparatus comprises a plate cylinder (15), a blanket cylinder(16) and an impression cylinder (17). A web (W) passes between the blanket and impression cylinder to enable print to be applied to the web by the blanket cylinder. The plate and blanket cylinders (15, 16) are provided as a one-piece cartridge movable axially to a position offset from the web. The impression cylinder (17) is also movable independently of the other cylinders to a position offset from the web to enable the impression cylinder to be changed without breaking the web or removing the web from the apparatus.

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PRINTING APPARATUS

The invention relates to printing apparatus and it is particularly concerned with printing apparatus such as an offset lithographic printing apparatus, which utilises a cylinder for applying print to a web.

Known offset lithographic printing machines comprise a plate cylinder to which ink is applied by rollers, a blanket cylinder which transfers the print from the plate cylinder to a web, and an impression cylinder which presses the web against the blanket cylinder. The blanket cylinder, will have a circumference corresponding either to the total print length or to a print length which is exactly divisible into the circumferential length of the blanket cylinder. Where a customer requires a print length which will not divide exactly into the circumferential length of the blanket cylinder, it is necessary to change the cylinder and, hitherto, it has been proposed to mount the blanket cylinder and plate cylinder in a cartridge which can be withdrawn axially to one side of the web. By doing that, the plate and blanket cylinders can be changed or cleaned easily.

If it is necessary to print on both sides of a web, it is usual to pass the web through a first print tower where print is applied to one side of the web, invert the web downstream of the first print tower and then pass the inverted web through a second print tower which applies print to the opposite side of the web. By doing that, the previously printed side of the web comes into engagement with the impression cylinder of the second print tower. As the printing is noramlly carried out

at high speed, the ink applied to the first side of the w b will often not be completely dry by the time it comes into engagement with the impression cylinder of the second print tower and ink will be transferred to that impression cylinder. Provided that the impression cylinder of the second print tower has a circumferential length which can be divided exactly by the print length applied by the first print tower, no problems arise. However, if the impression cylinder circumference is not so divisible, what is known as "ghosting" can occur where a second but lighter image of the print applied to the first side of the web is applied again to that side by the impression cylinder of the second print tower. Therefore, where the plate and blanket cylinders are changed in an upstream print tower it will generally be necessary to change both the plate and blanket cylinders and the impression cylinder of the downsteam tower in order to ensure that ghosting does not occur. In view of the fact that the web passes over the impression cylinder, it is necessary to remove the web from known machines when changing the impression cylinder which can be most inconvenient, particularly if numerous print towers are present in the machine. It is well known, that re-webbing a printing machine can be a long and complex operation and increases the time that the machine is out of service.

On certain prior art machines, it is known to provide the plate cylinder, blanket cylinder and impression cylinder as a single unit which can be mounted into or dismantled from a printing machine and an operator can carry various units having cylinders of set sizes. However, such units are very expensive as each one incorporates three cylinders and the unit is very heavy and difficult to install and remove. Also, it is essential to remove the w b from the machine in order to replace th three-cylinder units.

An object of the present invention is to provide printing apparatus which enables at least the impression cylinder across which the web passes to be replaced without having to break the web or remove the web from the machine.

According to one aspect of the invention there is provided printing apparatus comprising a printing cylinder for applying print to a web and an impression cylinder for maintaining the web against the printing cylinder, said printing cylinder being movable axially to a position offset from the web, said impresssion cylinder being movable axially independently of the printing cylinder to a position offset from the web.

According to another aspect of the invention there is provided printing apparatus comprising a printing cylinder for applying print to a web and an impression cylinder for maintaining the web against the printing cylinder, said impression cylinder being movable axially relative to the printing cylinder to a position offset from the web.

An arrangement as set out in either of the two immediately preceding paragraphs enables the impression cylinder to be moved to a position to one side of the web so that the impression cylinder can be changed without having to break the web or remove the web from the machine.

Preferably, the impression cylinder is mounted on slide means whereby the impression cylinder can be slid to the offset position.

The impression cylinder is preferably mounted between spaced support means, e.g. side plates. The impression cylinder may be rotatably mounted in journal bearings on the support means. The support means may have surfaces which engage the aforesaid slide means. Such surfaces may comprise arcuate cut-outs which rest on the slide means and which may be slidable therealong.

Such surfaces may be arranged on lower edges of said support means.

The printing cylinder, which is preferably a blanket cylinder co-operable with a plate cylinder, may be mounted between spaced further support means such as further side plates. The further support means may be carried by mounting means which enables the printing cylinder to be moved axially to a position offset from the web. The mounting means may be slidable on bearings and preferably takes the form of rails.

In a preferred embodiment, the printing and impression cylinders are arranged in a print tower of a printing machine downstream of a further print tower of the machine. Preferably, the further print tower applies print, in use, to one side of the web and the downstream print tower applies print to the opposite side of the web, the web moving through an inverting station between the print towers.

The impression cylinder and printing cylinder may be rotatably fast with meshing gear wheels which disengage each other when one of the cylinders is moved to its offset position. The impression cylinder gear wheel is preferably arranged to transmit drive to the printing cylinder gear wheel. Where a plate cylinder is provided, the printing (i.e. the blanket) cylinder gear wheel preferably meshes with a gear wheel rotatably fast with the plate cylinder so as to drive the latter. Preferably the impression cylinder gear wheel disengages a driving gear when the impression cylinder is moved to its offset position.

In a preferred embodiment drive from a main drive input is transmitted to the impression cylinder through an adjustable roller gear. The idler gear may be rotatably mounted on a movable arm to enable the position of the idler gear to be adjusted to mesh with respective gear

wheels on impression cylinders of different sizes. In that way different sized impression cylinder gear wheels can easily be made to mesh with the idler gear, the latter preferably being in constant mesh with a drive gear. Preferably the arm is pivotable about an axis of said drive gear.

Locking means, such as a screw and locknut arrangement, may be provided for locking said arm in position once the idler gear and impression cylinder gear are in mesh.

Printing apparatus in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

Fig.1 is a diagrammatic elevation of basic offset lithographic printing machine,

Fig.2 is a diagrammatic elevation of a known type of plate blanket and impression cylinder arrangement,

Fig.2a is a view of the arrangement of Fig.2 looking in the direction of arrow II in Fig.2,

Fig.3 is a diagrammatic elevation of a cylinder arrangement of an offset lithographic printing apparatus in accordance with the invention,

Fig.4 is a view of the cylinder arrangement of Fig.3 looking in the direction of arrow IV in Fig.3,

Fig.5 is a diagrammatic elevation of an offset lithographic printing machine having two print towers one of which includes apparatus in accordance with the invention.

Fig.6 is an elevation of a preferred form of printing apparatus in accordance with the invention.

Fig.7 is a cross section of the apparatus in Fig.6 on the line VII-VII in Fig.6, and

Fig.8 is a cross section of the apparatus in Fig.6 on the line VIII-VIII in Fig.6.

Referring to Fig.1, the basic offset lithographic printing machine comprises a main frame or bed 10 carrying a supply of paper web 12 which passes between feed rollers 13 arranged upstream of a print tower 14. The print tower contains the usual plate cylinder 15, blanket cylinder 16 and impression cylinder 17. Ink is applied to the plate cylinder 15 by a roller system 18 and moisture is applied to the plate cylinder 15 by a moistening roller system 19 in known manner. The printed web passes between take-up rollers 20 and is collected by a web take-up 22.

Hitherto, it has been known to mount the cylinders 15, 16 and 17 between steel side plates 23 as in Figs.2 and 2A to form a one piece unit. The unit can be installed or removed from the bed of the machine where a change of cylinder size is necessary. In order to maintain accuracy between the three cylinders, the side plates 23 have to be extremely robust and, as a result, the unit is generally very heavy and somewhat difficult to handle. Moreover, each of the units is expensive because it contains three complete cylinders whereas, in fact, on occasions it may be necessary only to change the impression cylinder, or to change the plate and blanket cylinders. We have previously proposed machines which have the plate and blanket cylinders mounted on a cartridge which will enable the plate and blanket cylinders to be changed independently of the impression cylinder, the latter remaining in place in the bed of the machine and being lifted out after removal of the web. Whilst this particular arrangement has been found satisfactory, it is still necessary to break the web or remove the web from the printing machine when lifting

the impression cylinder out of the bed.

Therefore, in accordance with the invention, the impression cylinder as shown in Figs.3 and 4 is mounted between end plates 24 spaced apart by suitable bars 24a. (Fig.3). The impression cylinder and side plate arrangement then constitutes a single cartridge 21 which is slidable on guide bars 25 mounted on main supporting plates 1 on a bed, so that the impression cylinder can be shifted to one side of the web W. In that way, it is possible to slide the impression cylinder 17 axially clear of the web as indicated in broken lines in Fig.4 so that it can be changed without the need to remove the web from the machine. The plate and blanket cylinders 15,16 are also mounted in a single cartridge 26 on guide rails 27. The Fig.3 arrangement is particularly useful where a machine is provided having more than one print tower as in Fig.5 the upstream print tower 30 being arranged to print on one side of the web W and the downstream print tower 31 being arranged to print on the reverse side of the web, the web being inverted at an inverting station 32 between the towers. As mentioned above, it is usual practice to invert the web for printing by the second print tower 31 and, in such a case, it is important that the impression cylinder 17 in the downstream tower 31, has a circumferential length which is exactly divisible by the print length applied by the upstream print tower. If the downstream print tower in such case has an impression cylinder not so divisible, it has previously been necessary to break or remove the web and lift out the impression cylinder 17 of the downstream print tower 31 or to replace all three cylinders if the tower has the three cylinder single unit arrangement shown in Fig.2. Fig.5 shows the downstream print tower having an arrangement of cylinders in accordance with the invention.

The present invention avoids the need to remove the web when changing the impression cylinder 17 of the downstream print tow r 31. Alsok the dual cartridge arrangement shown in Figs.3,4 and 5 enables the side plates to be less robust than in Fig.2 as they do not need to support three heavy cylinders. Therefore the Fig.3 arrangement is a less expensive proposition. An alternative size impression cylinder is indicated in broken lines in Fig.3.

Fig.4 shows the way in which the guide rails 25,27 may extend beyond opposite sides of the web so that the blanket cylinder and plate cylinder cartridge 26 can be moved to the right as viewed in Fig.4 whilst the impression cylinder cartridge 21 can be moved to the left. In that way, balance is maintained if both sets of cylinders are shifted axially to clear the web at the same time.

Reference is now made to Figs.6 to 8 which show a preferred form of apparatus in accordance with the invention. Parts in Figs.6 to 8 which correspond to parts in Figs.1 to 5 carry the same eeference numerals.

The main supporting plates 1 are spaced apart as shown in Fig.7. The right hand main plate 1 carries a gearbox 40 which receives drive from a drive input shaft 42 driven by a main motor (not shown). The gear box 40 has an output shaft carrying a sprocket 43 from which drive is transmitted by a belt 45 to a sprocket 44 on a driving shaft 46. The sprocket 44 also transmits drive to roller systems 18,19 of the type shown in Fig.1 by means of a toothed belt (not shown). The driving shaft 46 is rotatably mounted in main bearings 47,48 on the main plates 1 and by an outer bearing 49 supported by mounting bars 50 (one only of which is shown) on the right hand main plate 1. The driving shaft 46 is rotatably fast with a drive gear 52 which meshes with an idler gear 53 rotatbly mounted on bearings 54 on an arm 55.

The arm 55 is mounted for rotation on a bearing 56 on the driving shaft 46. The arm carries an adjustment handle 58 and rotatable locking bar 57. The handle includes a screw threaded shaft 59 which projects through an arcuate slot 60 in left hand main plate 1 and screws into a projection 62 on the arm 55. The locking bar 57 has a boss 63 which is screw threaded on to the shaft 59 and acts as a lock-nut for the shaft 59. With the boss 63 in a non-locking condition, the handle 58 can be moved up or down in the slot 60 to turn the arm 55 about bearing 56 and cause the idler gear 53 to roll around the drive gear 52. Once in the desired position the locking bar 57 is turned to engage adjacent main plate 1 and lock the shaft 59 against that main plate.

The idler gear 53 is positioned to mesh with a gear wheel 64 rotatably fast with an impression cylinder 17. A spacer 65 is positioned between the gear wheel 64 and the impression cylinder 17., The impression cylinder is integral with mounting shafts 66 which are rotatable in bearings 67,68. The bearings 67,68 are mounted in side plates 24 which are held spaced apart by suitable bars 24a. As apparent from Fig.6, the left hand side plate 24 in Fig.7 has two arms 69, the lower edge of each of which is formed with an arcuate cut-out 70. The cut-outs 70 rest on the upper edges of respective guide rails 25 extending between and mounted rigidly on the main plates 1 (Fig.8). The bearings 67,68 are mounted in an upward extension 61 of each side plates 24 and are tied together by bars 24a to form a one-piece unit or cartridge 21 which is slidable to the left the full line position shown in Fig.7 to the broken line position (shown in part only). In the broken line position, the impression cylinder 17 is positioned to one side of the web W and can therefore be changed without having to break the web or remove the web from the printing machine.

In the broken line position, the gear wheel 64 disengages the idler gear 53 and the new impression cylinder will have a different size wheel 64. In order to ensure that the new gear wheel 64 meshes with the idler gear, the position of the latter is adjusted into mesh by turning arm 55 with handle 58 when the new impression cylinder is moved into the full line position in Fig.7. The right hand side plate 24 (which has a similar profile to the left hand plate 24 as viewed in Fig.6) is formed with two dowel apertures 71 fitted with bushes 72. The apertures 71 (one only of which is shown) receive dowels 73 on the right main plate 1 which ensure positive location of the impression cylinder cartridge 21 relative to the plate 1. Similar dowels 73a (Fig.6) are provided on the left main plate 1 for location in dowel-receiving apertures 72a in the left hand plate 24 for positive location. Once in the Fig.7 full line position, suitable locking means (not shown) is provided to hold the cartridge 21 in place.

Fig.8 shows the guide rails 25 in greater detail. The left hand end of each rail 25 is formed with an axial screw-threaded bore 74 which receives a screw-threaded reduced diameter end 75 of an extension rail 76. The extension rails 76 have the same outer diameter as the rails 25 and are fitted when it is desired to move the impression cylinder cartridge 21 to the left clear of the web W. The arrangement shown in Fig.4 is very similar, the main guide rail being shown at 25 and the extension at 76.

The gear wheel 64 meshes with a gear wheel 75 rotatably fast with a blanket cylinder 16. A spacer 76 is arranged between the gear wheel 75 and the blanket cylinder. The blanket cylinder is rotatable on bearings 77 mounted on a shaft 78 supported by adjustment elements 88,89 on left and right hand upper side plates 80. The gear wheel 75 meshes with a gear wheel 82 rotatably fast with a plate cylinder 15. A spacer 83 is arranged between

the gear wheel 82 and the plate cylinder 15. The plate cylinder 15 has integral stub-shafts 84 which are mounted for rotation in bearings 85 supported through adjustable intermediate elements 86,87 by the upper side plates 80. The blanket cylinder 16 can be urged downwards to apply presure to the web supported by the impression cylinder by adjustment elements 88,89 and the plate cylinder can be urged against the blanket cylinder by elements 86,87. Adjustment devices (not shown) are also provided for moving the impression cylinder 27 towards or away from the blanket cylinder.

The upper side plates 80,81 are bed together with bars 92 and along with the cylinders 15,16 form a cartridge 26 slidable to the left clear of the web W as shown in broken lines in Fig.7.

The upper end plates 80 have lower edges attached to mounting rails 27 which are mounted for sliding on rollers 93 on the main plates 1 (the rollers 93 having horizontal axes) and between rollers 94 having vertical axes. A handle 100 is provided on one of the rails 27 for moving the cartridge 26 to one side. The right hand end of each rail 27 is formed similarly to the left hand end of each rail 25 to enable extensions 95 to be screwed thereon before the cartridge is moved. A dowel location system may be provided similar to the dowel 73 and aperture 71 arrangement for cartridge 26.

As in Fig.4 the cartridges 21,26 could be movable in opposite directions clear of the web.

Where the cartridges are moved into their Fig.7 full-line positions, the rollers are rotated slightly by hand if necessary to ensure that the gears 53,64 (see also Fig.4) of the rollers slide into mesh.

CLAIMS

1. Printing apparatus comprising a printing cylinder (16) for applying print to a web (W) and an impression cylinder (27) for pressing the web agains the first cylinder, said printing cylinder being movable axially to a position offset from the web, characterised in that said impression cylinder (17) is movable axially independently of the printing cylinder (16) to a position offset from the web (W).

2. Printing apparatus according to Claim 1 characterised in that the impression cylinder (17) is mounted on slide means (25) whereby the impression cylinder (17) can be slid to the offset position.

3. Printing apparatus according to Claim 1 or 2 characterised in that the impression cylinder (17) is mounted between spaced support means (24).

4. Printing apparatus according to Claim 3 when appendant to Claim 2 characterised in that the support means have surfaces (70) which engage said slide means.

5. Printing apparatus according to Claim 4 characterised in that the surfaces (70) are on lower edges of the support means.

6. Printing apparatus according to any preceding claim characterised in that the printing cylinder (16) is mounted between spaced further support means (80).

7. Printing apparatus according to Claim 6 characterised in that the further support means is carried by mounting means (27) which enables the printing cylinder (16) to be moved to its offset position.

8. Printing apparatus according to Claim 7 characterised in that the mounting (27) is slidable on bearings (93,94).

9. Printing apparatus according to any preceding claim characterised in that the printing and impression cylinders (16,17) are arranged in a print tower (31) of a printing machine downstream of afurther print tower (30) of the machine.

10. Printing apparatus according to Claim 9 characterised in that the further print tower (31) applies print, in use, to one side of the web (W) and the downstream print tower applies print to the opposite side of the web (W), the web moving through an inverting station (32) between the print towers.

11. Printing apparatus according to any preceding claim characterised in that the impression cylinder (17) and printing cylinder (16) are rotatably fast with meshing gear wheels (64,75) which disengage each other when one of the cylinders is moved to its offset position.

12. Printing apparatus according to any preceding claim characterised in that the impression cylinder (17) is rotatably fast with a gear wheel (64) which disengages a driving gear (53) when the impression cylinder is moved to its offset position.

13. Printing apparatus according to any preceding claim characterised in that drive from a main drive input (42) is transmitted to the impression cylinder through an adjustable idler gear (53).

14. Printing apparatus according to Claim 13 characterised in that the idler gear (55) is rotatably mounted on a movable arm (55) to enable the position of the idler gear to be adjusted to mesh with respective gear wheels (64) on impression cylinders of different sizes.

15. Printing apparatus according to Claim 14 in which the arm is pivotable about an axis of a drive gear (52) driven by

said main drive input.

16. Printing apparatus according to Claim 14 characterised in that the idler gear (53) meshes with said drive gear (52) and said gear wheel (64) on the impression cylinder (17).

17. Printing apparatus according to Claim 14, 15 or 16 characterised in that locking means (57) is provided for locking the arm (55) in a desired position.

18. Printing apparatus according to any preceding clai characterised in that the printing cylinder (16) is a blanket cylinder inked by a plate cylinder (15).

Fig. 1.

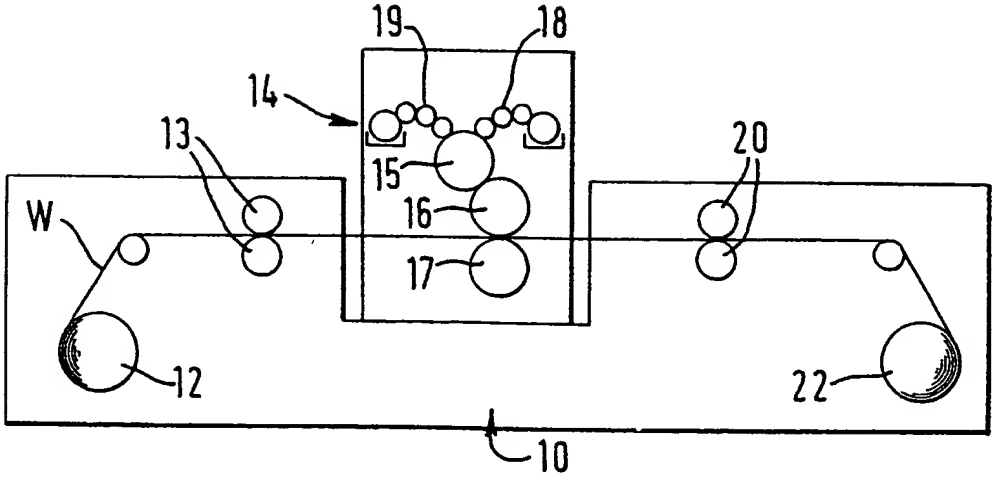

Fig. 2.

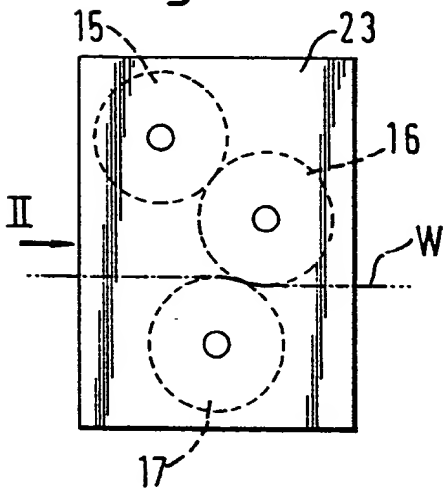

Fig. 2A.

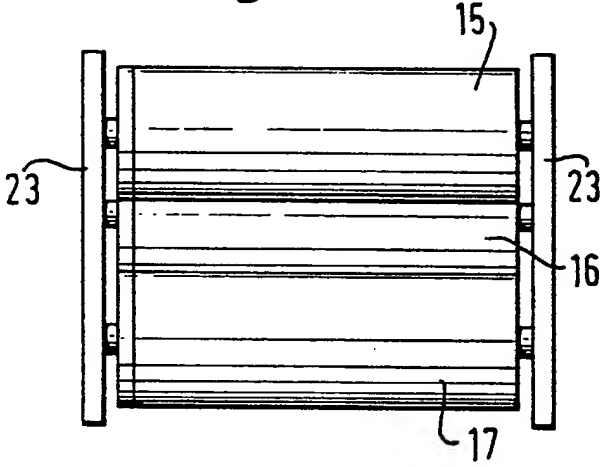

Fig. 5.

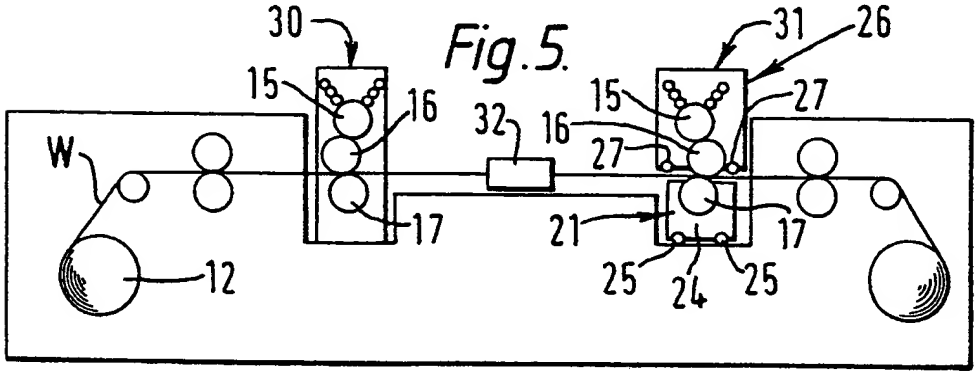

Fig.3.

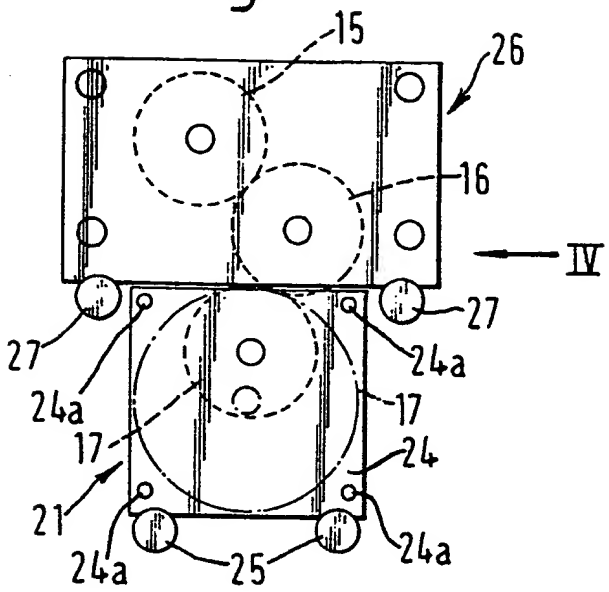
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Fig.4.

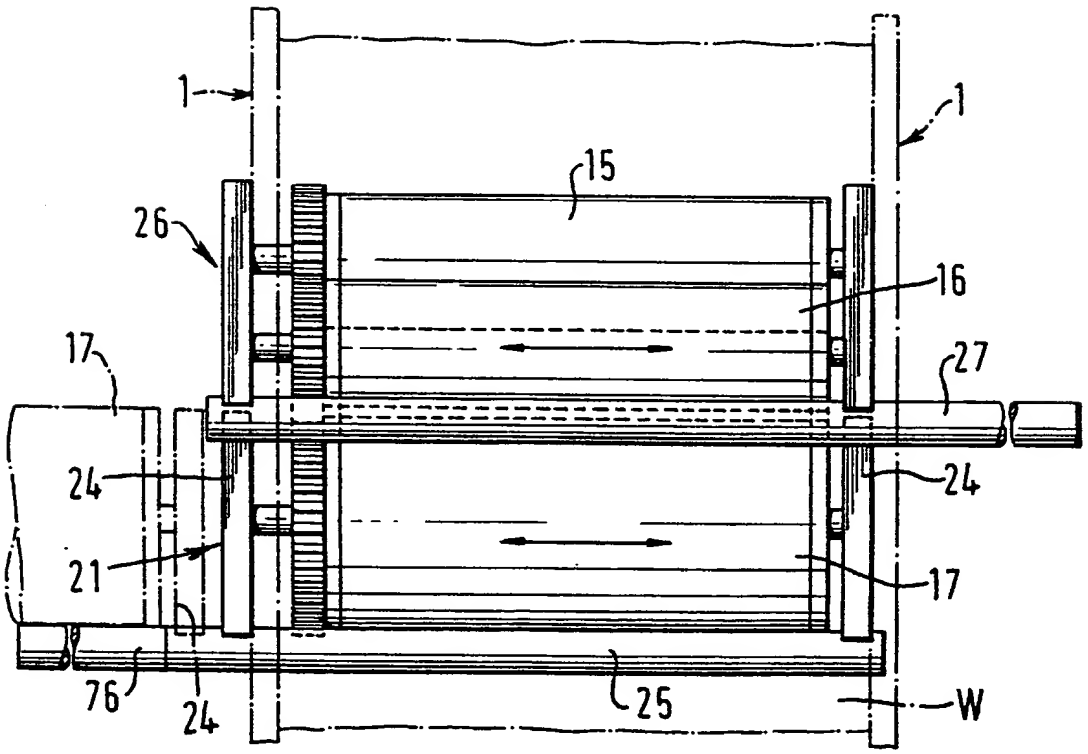
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Fig. 6.

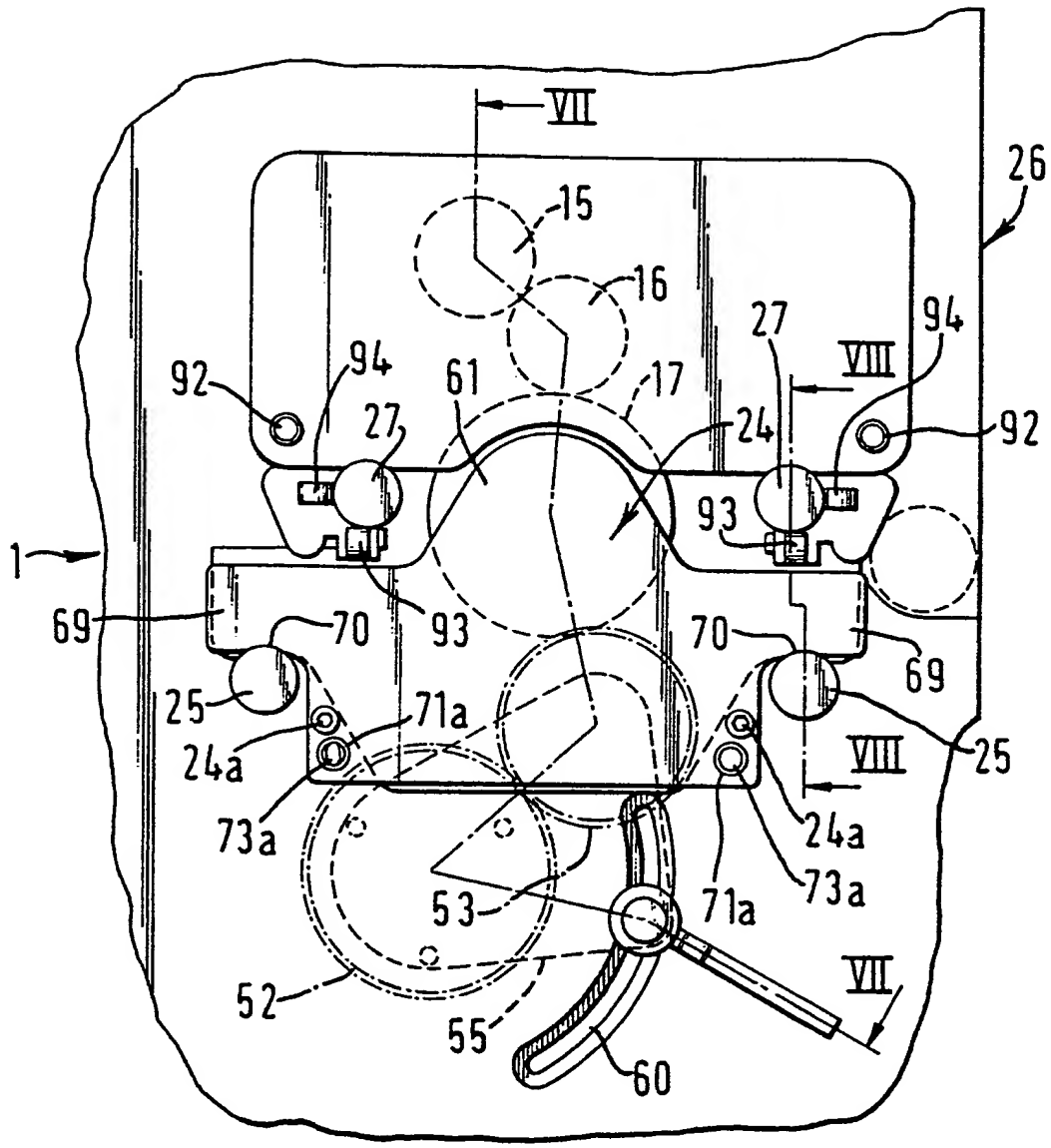
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Fig. 7.

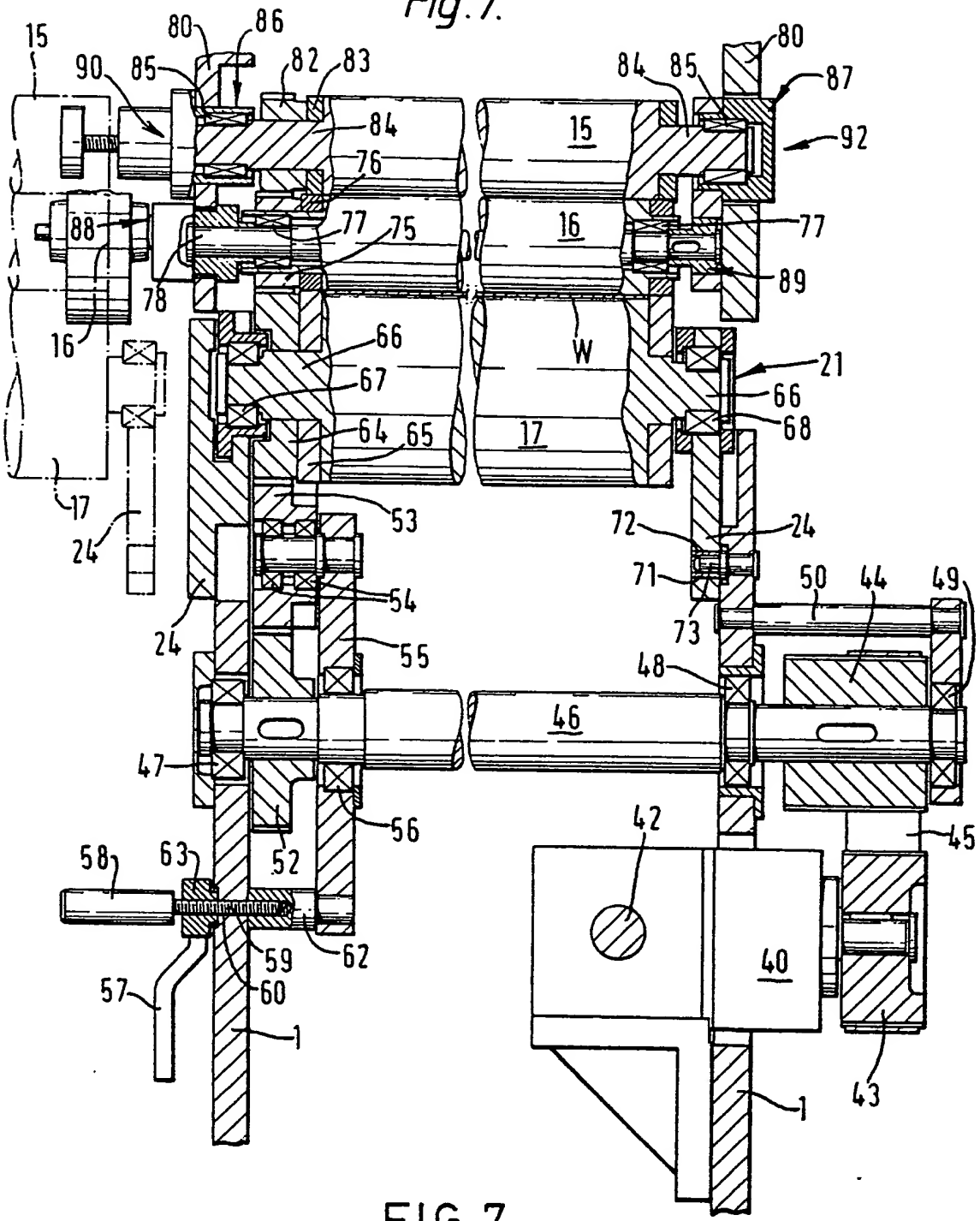
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FIG. 7.

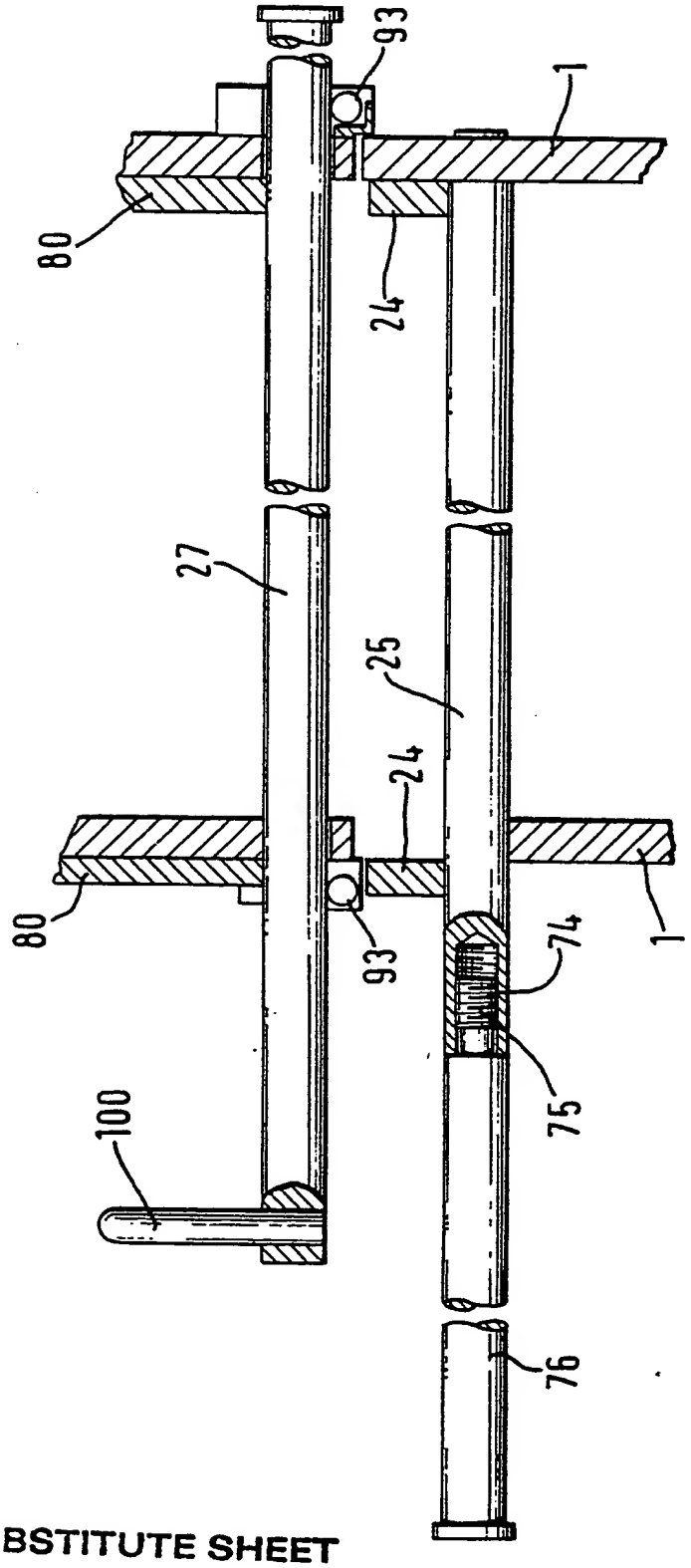

Fig.8.

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 87/00077

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: B 41 F 13/44; B 41 F 13/24

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	B 41 F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with Indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	GB, A, 1434602 (JAMES HALLEY & SONS Ltd) 5 May 1976 --	1-8
A	EP, A, 0095423 (MACHINES CHAMBON S.A.) 30 November 1983 --	1-18
A	GB, A, 2046664 (FRANK McKAY BIGGAR III) 19 November 1980 --	
A	FR, A, 2420426 (MACHINES CHAMBON S.A.) 19 October 1979	

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
31st March 1987	12 MAY 1987
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	L. ROSSI

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/GB 87/00077 (SA 15995)

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GB-A- 1434602	05/05/76	None		
EP-A- 0095423	30/11/83	FR-A,B	2527519	02/12/83
		JP-A-	59031162	20/02/84
		US-A-	4462311	31/07/84
GB-A- 2046664	19/11/80	FR-A-	2451265	10/10/80
		DE-A-	3010244	06/11/80
		JP-A-	55166249	25/12/80
		SE-A-	8002075	16/09/80
		CA-A-	1155001	11/10/83
		CH-B-	652652	29/11/85
		NL-A-	8001908	01/10/81
		US-A-	4413541	08/11/83
FR-A- 2420426	19/10/79	None		